
Defense Science And Technology Seminar on Emerging Technologies

POLYMER NANOCOMPOSITES
Advanced Packaging Materials for Rations

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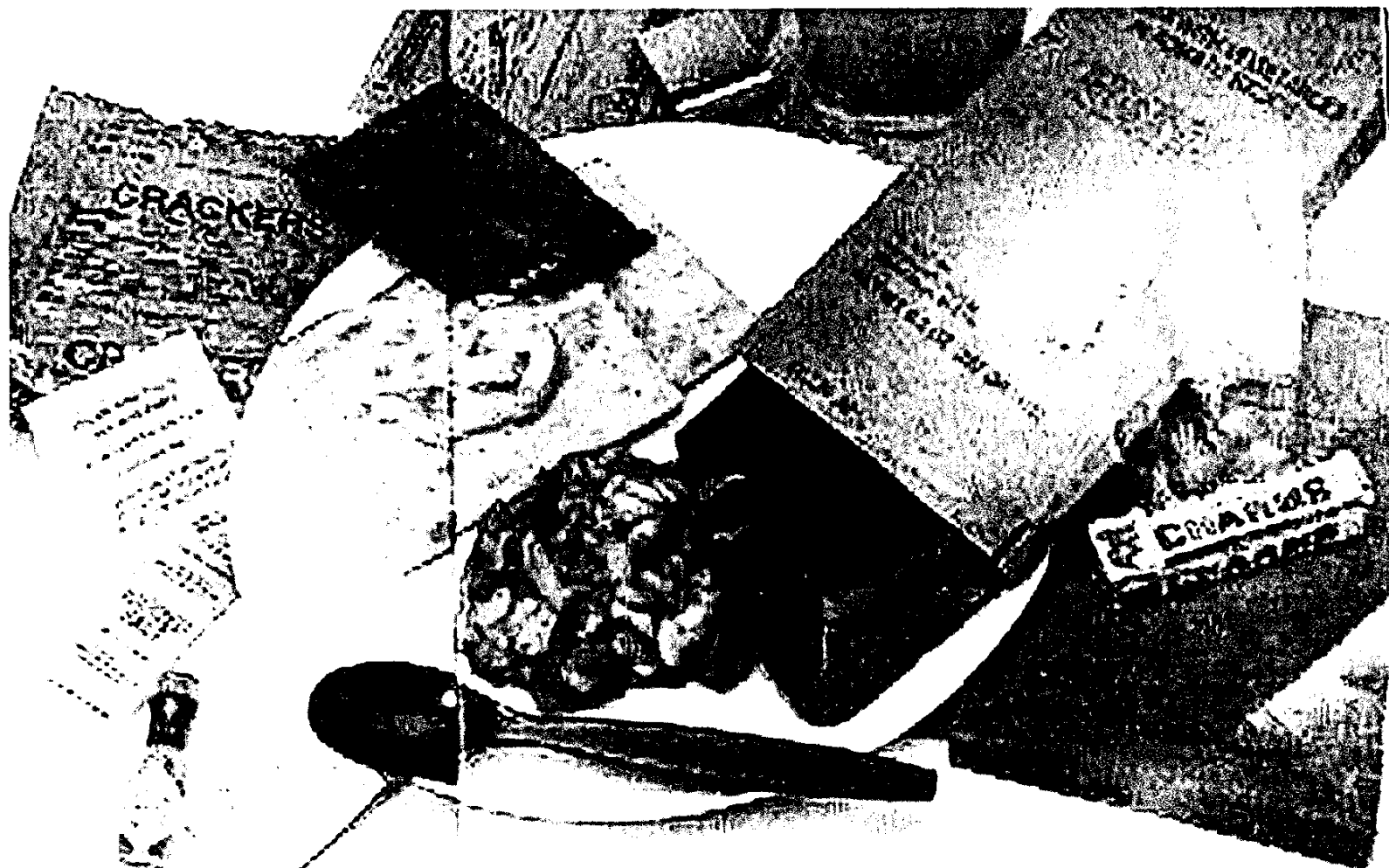
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The Need for Advanced Packaging Materials for Rations

- **Requires long shelf-life - *3 years***
- **Must survive severe weather conditions**
- **Must survive air-drop delivery**
- **Food must retain its flavor**
- **Materials must be inexpensive**



"Meal, Ready-To-Eat"



Photograph by Les Jorgensen
American Heritage of
Invention & Technology
Summer 1998



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Summer 1998

Keys Ration's Dinner Unit

POLYMER LAYERED SILICATE NANOCOMPOSITES

Turning *Commodity* Polymers Into *Specialty* Polymers

- **Enhanced Gas-Barrier Performance**
- **Enhanced Thermo-Mechanical Properties**
- **Enhanced fire-resistance**
- **Amenable to Established Processing and Fabrication Techniques**
- **Provides 'Drop-in' Solution**
- **Cost-effective**



POLYMER LAYERED SILICATE NANOCOMPOSITES

{ Commodity Polymers + 2-10 wt.% of layered silicate/clay reinforcements }

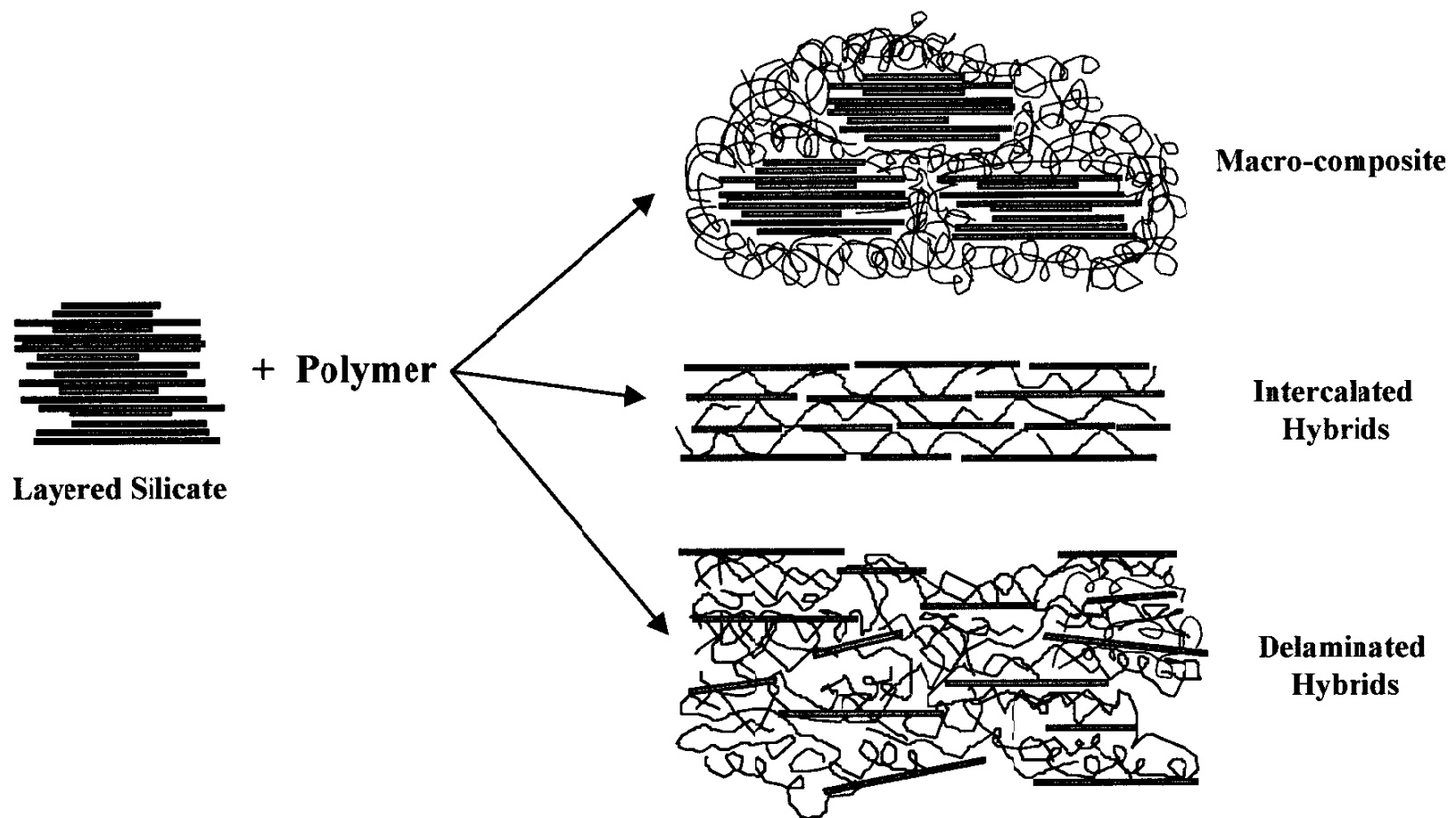
NANOCOMPOSITES

- **Enhanced Barrier Properties**
- **Enhanced Thermo-mechanical Properties**
- **Enhanced Physical Properties**
- **Low Processing Cost**
- **Single-step Processing**
- **Light-weight**

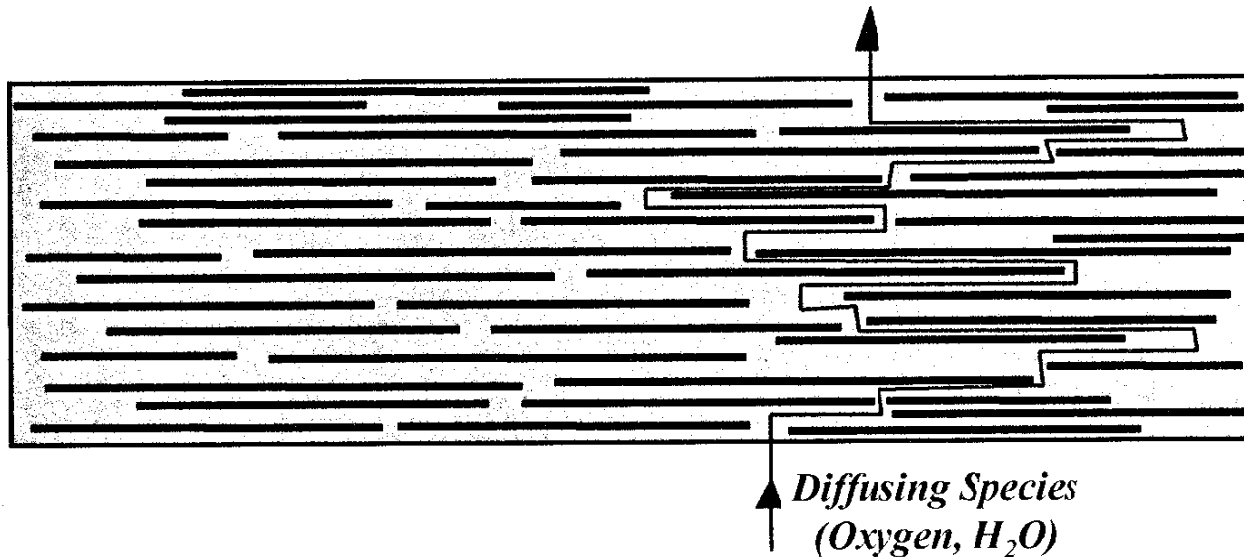
Solvent-free Direct Melt-Processing



POLYMER LAYERED SILICATE (NANO)COMPOSITES

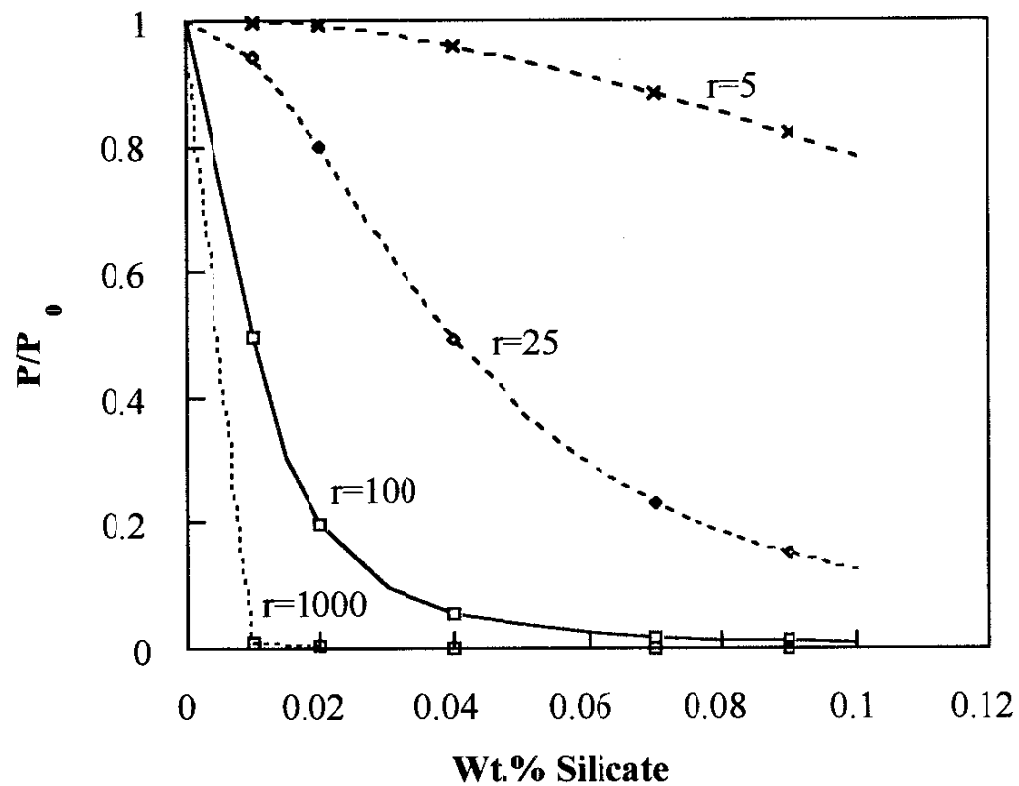


POLYMER LAYERED SILICATE (NANO)COMPOSITES



- ** Enhanced Barrier Properties due to the increased effective diffusion distance**
- ** Other effects due to truly *nanoscale* polymer-inorganic interaction**

Relative Gas Permeability as a Function of Wt% Layered Silicate & Aspect Ratio (r)



Ref. Cussler *et al.*

POLYMER LAYERED SILICATE NANOCOMPOSITES

- *Relevant Applications*

- Polymer '3-year meal tray'
- Flexible Pouches
- Soldier uniforms
- Tentage applications
- Numerous commercial applications

